

**PHYSICS 6N**  
**ELECTRICITY AND MAGNETISM**

**LABORATORY MANUAL**

**SPRING QUARTER, 2016**

# PHYSICS 6N LABORATORY MANUAL

SPRING QUARTER, 2016

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## INTRODUCTION

Welcome to Physics 6N, the electromagnetism laboratory. The authors have endeavored to convey with hands-on experiments the many challenging yet beautiful concepts of the lecture course, Physics 6C. It is our hope that you will enjoy learning the rich subject of electromagnetism, and its many applications to modern technology.

You may find the format and style of the physics labs quite different from your typical chemistry or biology laboratory. In chemistry and biology, you are expected to learn and retain specific techniques, such as quantitative and qualitative analysis, spectroscopy, and so forth. By contrast, the physics lab is *not* a techniques laboratory; it is a *concepts* laboratory. Although you will learn many important techniques (such as the proper use of an oscilloscope), the overwhelming stress is on understanding the deep physical principles that govern the physical world. A firm understanding of these principles should make it much easier for you to learn the technique-intensive subjects that you are also studying.

You will also find that the manual dwells at some length on the theoretical ideas behind the experiments. This is because it is often impossible to schedule the laboratory to closely follow the lecture material; in some cases the labs actually precede the lectures. Often you might miss the lecture. This is why the laboratory instructor is asked to spend time at the beginning of each lab explaining both the theory and the techniques being used.

### Course Registration

Physics 6N is a stand-alone course, for which you must register. Decide carefully which section you want to attend, because, due to space limitations, it may not be possible for you to change sections later in the course. Make sure that the section that you actually attend is the one in which you have enrolled, or your grade may be in jeopardy.

### Laboratory Sections

Each laboratory section will meet once per week. There will be about 20 students in each section. Each section will be led by a Teaching Assistant, who is likely a graduate student in Physics.

In order to get credit for your work, you must attend the laboratory section in which you are officially enrolled. *You will only get credit for attending another section (“crashing”) if you have written permission, in advance, from both teaching assistants. In this case you must turn in the report to the TA when you are finished, and ask him or her to deliver the report to your regular TA.*

### Notebooks

Please purchase the notebook that the bookstore has put aside for the physics introductory laboratories. It is a bound notebook with vertical and horizontal (quadrille) rulings, about 60 pages and approximately 8 inches by 10 inches. Please enter the course number, the quarter, and the TA's name on the inside cover of your notebook. You may use your

notebook from a previous quarter if there is still space in it, but be sure to update the course information.

The following records are **not** acceptable: loose-leaf binders, spiral-bound notebooks, and notebooks that have line ruling rather than graph-style quadrille ruling. *Please note that, after the first lab section, your work will be marked down if you turn it in on loose sheets of paper. The same applies to notebooks that are spiral bound or not quadrille ruled.*

Leave your notebooks with your TA at the end of each lab section, so that he or she can look over your work and make comments on it. If you don't understand or agree with your TA's comments, discuss them with him or her. For further details, please refer to **Guidelines for Laboratory Reports** in the Appendix.

### **Lab Partners**

Work with a partner on each of the experiments. Since report preparation is an important part of the laboratory work, each of you should prepare your own notebook. Although you should feel free to refer your reader to a partner's notebook for a table of raw data, *etc.*, your calculations, descriptions, comments, and conclusions should be independently recorded.

Include your partner's name when you describe an experiment. It will make it easier for your instructor. Try to choose a different partner each week. It's a chance to make new friends and to stimulate new thinking.

### **Pre-laboratory Questions**

You will find pre-laboratory questions at the end of each chapter of this manual. These questions are intended to prepare you for the concepts and calculations that you will need for the laboratory, and are guaranteed to save you a significant amount of lab time. For this reason, it is a good idea to keep a copy of your prelab solutions with you as you do the lab. *Please submit solutions to the questions to the TA on a separate sheet of paper when you report to the laboratory class.* Late submissions will not be accepted for credit.

### **Grades**

Your work will be appraised with a letter grade. Your grade will be based upon all of the scheduled laboratories. If you miss one lab for a documented medical or family emergency, *and you notify your TA in advance and in writing*, your grade will be averaged over the remaining laboratories. If you otherwise miss a single laboratory, your final grade will be averaged over the remaining labs, but then reduced by a full letter grade. If you miss two labs for a documented medical or family emergency, *and you notify your TA in advance and in writing*, you may, before the end of the last week of instruction, petition in writing for an incomplete (I). If you miss two labs for any other reason, you will not pass the course.

Please notice that your solutions to the pre-laboratory questions will comprise a significant part of the lab grade. For further information about grading, please refer to the appendix, Guidelines for Laboratory Notebooks.

**Laboratory Etiquette**

As a courtesy to your fellow students, when you are finished with the laboratory, please make sure that all of the equipment is intact and organized in an orderly way. If any equipment is missing or not working properly, please notify the instructor.

Also, please do not bring food or drink into the laboratory. You may leave such items on the shelves in the hallway to consume elsewhere. Finally, by order of the Fire Marshall, under no circumstances may bicycles be brought into the laboratory. Bike racks are available at either end of the building.

**Final Comments**

If you have any suggestions or comments about the laboratory experiments or the manual, please let me know. In the mean time, we hope that you enjoy this course, and that you will find many examples of the experiments in your everyday life. Please send your comments to the laboratory manager, who can be contacted at [gsbrown@ucsc.edu](mailto:gsbrown@ucsc.edu) and who sometimes resides in 111D Thimann Laboratories.

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